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The Future for Trade Associations

We would like to see every foundry owner in possession of "The Organisation of British Industry," which is a Report just issued by a Committee of the Federation of British Industries, because it clears up so many misconceptions held by the innate individualist. Moreover, it is the most forward-looking document as to the directions which post-war business will take that we have so far encountered. Everybody now is thinking about decontrol; it is realised that the solution of this difficult problem will have, for good or ill, far-reaching effects. It seems to us that the Government departments will be able to liquidate the controls both quicker and more efficiently if they can deal with really representative trade associations than with numberless individual firms.

The Report confirms what we have already found in practice, and that is the Export Groups cannot usefully continue to be divorced from the activities of the corresponding trade association Yet under existing conditions there remains the difficulty that whilst the latter is obviously selective as to membership, the former are by law open to any firm prepared to pay the fees in vogue. The advice of the Report is "The course to be pursued should be that where trade associations exist their functions should be extended to cover those of the corresponding export groups, as the latter are not fitted to deal with the work of trade associations."

An excellent piece of advice is given as to the main objective for trade associations, which in short is—give service to the consumer of your products, plus an equal service to the nation at large. The second function is nowadays made possible as so many Government departments—though not all—prefer to deal with trade associations. The enthusiasm for the continuation of the contacts established will obviously depend on the integrity and capability shown by the officers of the trade associations. We would especially direct the attention of foundry proprietors to clause 10 of the Report, which details the functions of trade associations. They are so complete that they should be the basis of their Articles of Association. They number 12, and each one could very well carry a sub-committee to see that each function is properly performed. Where an association is too small to carry out a prescribed function, then it should associate itself with a group of others similarly placed for joint action.

The 12 Committees might carry the following titles:—Policy (for treating with Government committees); Co-ordination (for negotiations with other organised activities); Production (to align production with consumption); Fair Trading; International Relations (to treat with opposite numbers abroad); Statistical; Costing; Export; Propaganda; Research; Education; and Commercial Development (standardisation, design, etc.). The organisation of such Committees would help to maintain interest in the Associations by spreading the work over a larger number of members, or if the Association be too small, a request that a representative be appointed to the committee of an allied association; a co-operative research organisation or a technical institute would rarely be refused. The main factor is that not one of these functions should be neglected.

We want every small foundry owner to associate himself with the trade associations and to make himself heard. He has his special problems which any well organised association is capable of solving. If, as we believe, trade associations will be accorded Government recognition, there will be an onus imposed upon them to make the industry concerned truly efficient, and this can only be attained by giving added attention to the smaller units.

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NOTES FROM THE BRANCHES

Scottish Branch.—The branch opened the session on October 14 with a record attendance of about 160, including members and friends. Mr. Young, the retiring President, was in the chair, and thanked the members for the support given him last year, a support which, he said, according to the attendance at this meeting, was likely to be improved upon in the session on which they had just entered. He congratulated the members on their choice of President for 1944-45, and assured them that by training, experience, and temperament, Mr. Tyrie is well fitted for his duties. He had pleasure in asking Mr. Tyrie to take the chair.

MR. TYRIE, whose Presidential Address will appear in a future issue, thanked the members for the magnificent attendance at the opening meeting, and expressed the hope that this standard would be maintained during the session. He also thanked Mr. Young for the fine manner in which he had conducted the affairs of the branch last session, and for having brought it up to its present high standard. After the Presidential Address, Mr. John Vickers introduced the sound film, "Wartime Calls on Women to make Aluminium Air-cooled Cylinder Heads." He gave a *résumé* of the film, and referred to the principal points to be noted, and, at the conclusion, he replied to one or two points which were raised by members. The opportunity was taken also to show another sound film—a news reel—and for this and the use of the sound projector the branch is indebted to Mr. David Murray, the Scottish Regional Works Relations Officer, Ministry of Supply, and his staff.

London Branch.—There was a record attendance of members when Mr. Malcolm Brown, works manager of Hadfields, Limited, of Sheffield, addressed them on the subject of "Steel Castings" at the Charing Cross Hotel recently. Mr. A. J. Murphy, M.Sc., acting president, was in the chair. The lecturer, by means of samples and lantern slides, detailed the successful manufacture of a complicated aircraft casting. He outlined the difficulties both persistent and transient which had been overcome. After a prolonged and interesting discussion, he was cordially thanked on behalf of the members by Mr. Frank Rowe and Mr. P. Fassotte. It was announced that in place of the symposium on "Moulding Boxes," scheduled to take place at 2.30 p.m. on November 18 at the Charing Cross Hotel, Dr. Skerl had kindly consented to present a Paper on "Recent Developments in Coremaking Materials."

Bristol and West of England Branch.—The new session opened on October 7 at the Grand Hotel, Bristol, Mr. E. Griffin presiding. Mr. J. W. Gardom, the President of the Institute, was also present, and in a short address expressed his pleasure at the progress made by the branch and the enthusiasm shown by the members. Mr. F. A. Allen presented a Paper on "Statistical Quality Control of Light Alloy Castings," which was followed by high tea and a concert.

SAVE PAPER WHEN YOU CAN

INSTITUTE CALENDAR

MEETINGS FOR NOVEMBER

Middlesbrough Branch.—"Mechanical Aids to Core Production," by J. Blakiston, A.M.I.Mech.E. At the Cleveland Technical Institute, Middlesbrough, November 10, at 7.30 p.m.

Bristol Branch.—"Wartime Calls on Women to Make Aluminium Air-cooled Cylinder Heads" (sound film). Also a film on "Pig-iron Production." At the Grand Hotel, Broad Street, Bristol, November 11, at 3.0 p.m.

Lancashire Branch.—"Gravity Die-castings," by A. R. Palmer. At the Engineers' Club, Albert Square, Manchester, November 11, at 3.0 p.m.

Lincoln Section.—"Foundry Loading and Planning," by A. Tipper. At the Technical College, Lincoln, November 11, at 3.0 p.m.

Scottish Branch.—1944 "John Surtees" Gold Medal Papers will be read by the winners: R. D. Cheyne and J. G. Nisbet. Subject: "The Basic Principles Involved in the Feeding of Castings and the Manner in which They May Be Applied in Practice, Particularly in the Case of Metals and Alloys which Show a High Shrinkage." Presentation of Institute Diplomas. At the Royal Technical College, George Street, Glasgow, November 11, at 3.0 p.m.

West Riding of Yorkshire Branch.—"What the Engineer Expects from the Foundry," by W. P. Eastwood, M.I.P.E. Replied to by A. S. Worcester, representing the foundry trade At the Technical College, Bradford, November 11, at 6.30 p.m.

East Midlands Branch.—"Cupola Control," by C. A. Payne, B.Sc. At the Technical College, Derby, November 18, at 6.0 p.m.

Falkirk Section.—"The Design and Testing of Space Heaters," by J. S. Hales, B.Sc. At the Smoke Room, Temperance Café, Lint Riggs, Falkirk, November 24, at 7.0 p.m.

Birmingham Branch.—"The Principles of Mechanical Handling," by J. V. Smith. At the James Watt Institute, Great Charles Street, Birmingham, November 25, at 2.30 p.m.

Sheffield Branch.—Joint meeting with the Iron and Steel Institute. Discussion of Paper on "The Side Feeding of Steel Castings—A Note on the Influence of the Mechanism of Freezing," by B. Gray. At the Royal Victoria Hotel, Sheffield, November 27, at 7.0 p.m.

The Ministry of Labour and National Service has issued an "Industrial Relations Handbook," prepared originally for the use of officers of the Ministry of Labour and National Service. It has now been issued for general publication in the belief that the information contained in it will be of wider interest, particularly to employers' organisations and trade unions. Copies may be ordered direct from H.M. Stationery Office, London (price 3s. 6d. net).

THE MECHANISED PRODUCTION OF ALUMINIUM GRAVITY DIE-CASTINGS FOR THE MERLIN ENGINE

Advantages of gravity die-casting over sand castings

By JOHN VICKERS

This paper, which was presented to the 41st annual meeting of the Institute of British Foundrymen held in Manchester, was also sent to the American Foundrymen's Association as an official Exchange Paper. Properly to appreciate this Paper, reference should be made to Mr. Vickers' earlier Paper covering the manufacture of the sand-cast components. It appeared in the Proceedings of the I.B.F. for 1942-43.

PART I.

Speaking broadly of the aluminium alloy castings on the liquid cooled aero-engines of Rolls-Royce, Limited, experience has shown that invariably where a part could be produced as a gravity die-casting, many advantages were possible over sand castings. The principal of these can be summarised as follow:—(*a*) Smoother finish and closer dimensional accuracy; (*b*) greater possible speed of production; (*c*) conservation of raw material; (*d*) reduction of production scrap; and (*e*) improved mechanical properties in the casting.

For this reason Rolls-Royce, Limited, have adopted the policy of producing as many of the castings on the Merlin engine as possible by die-casting, and the extent to which this has been carried out may be gauged from the fact that, of the 130 castings on the engine, 103, or nearly 80 per cent. of the total, are produced as gravity die-castings.

The cost of manufacture of the die, or permanent mould as it is known in America, is, however, frequently more than that involved in the manufacture of the necessary pattern equipment for the production of castings by the "sand-cast" method, but, if the quantities required off a particular casting would warrant the expenditure on a die, the reduced cost per casting would soon "write-off" the difference in cost of the two types of tooling, and the part could then be looked upon as a potential die-casting.

Die Development

When a drawing is presented to the foundry for the production of castings, it is the responsibility of the foundry chief inspector, being fully conversant with engine development, to ensure that the drawing is of the latest issue. Whether or not further inquiries into the prospect of producing castings by the gravity die-cast method are justified depends upon machine-shop requirements, and this position must also be ascertained by him before the drawings can be released for further investigations.

Having passed satisfactorily these inquiries, the drawing is accepted by the die development department, where the responsibility rests for the determination as to whether or not, mechanically and metallurgically, it is possible to produce the castings required as die-castings. Where the part does not lend itself to die-casting, due to the presence of awkwardly placed undercuts, etc., endeavours are made to have the design modified, without materially impairing the technical value of the casting, to make possible its manufacture by gravity die-cast methods.

Die Design

The essential and all important organisational feature of the Rolls-Royce Company's staff set-up is the fact that the chief die designer is also responsible for the control of the experimental die foundry, which will be described later, but of which it should be worthy of note at this stage that every die must be passed out with an approved technique and producing perfect castings, dimensionally, radiologically and mechanically, with not more than 5 per cent. scrap over a run of 100 castings minimum.

The practicability of the proposed die-casting having been ascertained, the chief die designer then determines the gating system, together with the position of the "die-parting," the location and direction of extraction of cores, the method of release of the casting from the die, general die shape and thickness, etc., passing this information on to the foundry die drawing office, who proceed with the completion of the detail drawings for the die.

Where it has not been found possible or necessary to have modifications made to the general design of the casting to simplify production, the decision is also made at this stage, by the chief designer, as to whether the die will incorporate multipiece cores or result in a semi-die-casting, i.e., making use of sand cores. The use of sand cores is discouraged for various reasons, principally because by adopting this method a certain degree of accuracy is lost through core location and, secondly, the presence of an oil-sand core results in the generation of core gases present during casting —a feature which is avoided as far as possible.

The extent to which this policy of eliminating the use of sand cores has been applied can be seen from the fact that, of the 103 die-castings on the Merlin XX engine, only nine, or 8.7 per cent., have their internal passages formed by the use of sand cores.

Aluminium Gravity Die-Castings

GRAVITY DIE CASTINGS.

STANDARD PRODUCTION TECHNIQUE.

Part No. D.14864. Mat. R.R.50

Description: Cover Plate and Guide

Die Preparation

F.S.14 die-coat to be used. Normal applications to die cavity and cores. Heavy coating to be given to risers.

All bearing surfaces to be lubricated with colloidal graphite.

After each cast, all cores and pick-off pieces to be plunged into colloidal graphite, to facilitate their easy removal from the casting.

Asbestos insulation on outside of die blocks to be renewed periodically.

Casting Technique.

Die temperature	300 to 350 deg. C.
Pouring temperature ..	710 to 720 deg. C.
Pouring time	5 seconds.

Metal to be poured smoothly down sloping runner.

To avoid wrenching, pick-off pieces to be tapped with small mallet when removing from casting.

Clearance of vent plug to sand core to be verified prior to casting to ensure that core gases do not enter the casting.

Production Statistics.

No. of casters	2	Cooling time	60 to 90 seconds.
Casting cycle time ..	5 minutes	Rate per hour	12

Bonus time allowance .. 24 minutes.

Inspection Report on Trial Batch of 100.

Inspection.	Quan. Scrap.	Reason for rejection.
Chalk test	5	Surface cracks under top flange caused through wrenching loose pieces on removal.
Pressure test ..	Nil	—
Final dimensional ..	Nil	—

Total percentage scrap—5.

Issued by M. R. Hinchcliffe. Date 20.8.42.

FIG. 1.—EXAMPLE OF STANDARD LAYOUT OF PRODUCTION TECHNIQUE.

Die Drawing Office

In order to utilise, to the fullest extent, semi-skilled and trainee labour in the foundry tool room in the manufacture of the die, the policy of the foundry drawing office, when preparing the detail drawings, is to make fully detailed drawings of all the die components, having them cross-referenced with the indexed general arrangement drawing. Originally this plan was operated as an experiment with the main object of conserving skilled tool-making labour, but the results proved that, in addition to easing considerably this particular problem, other equally important advantages became apparent, *viz.*, increased speed of die-making, with the manufacturing cost greatly reduced. The procedure from that date was automatically incorporated in the die drawing office routine.

Another point demanding special attention is the fact that all runners, gates and risers are accurately dimensioned, to which sizes the tool room must work instead of, as is normal practice, leaving this, to a certain extent, to the discretion of the die-makers. Before a drawing may be released to the tool room for commencing manufacture, it is meticulously checked, first by the chief draughtsman, who will satisfy himself upon the dimensional accuracy, then the chief designer will check the design and initial his approval that the drawings are in accordance with his instructions. Final approval must be received from the foundry manager before the tool-room superintendent will accept the design as official and proceed with manufacture.

During the process of manufacture of the die in the tool room, any alteration or modification found to be necessary or advantageous must first receive approval from the die designer before incorporation in the die. The details of these adjustments are then passed to the drawing office so that the original drawings may be brought up to date.

Experimental Die Foundry

On completion, the die, fully assembled, is passed by the tool room to the experimental die foundry, where it is fully tested. As a result of this testing, the most suitable technique is developed for production and all the most important factors, such as:—(*a*) Die-coating and its application; (*b*) pouring temperature of metal; (*c*) die temperature; (*d*) method of pouring; and (*e*) production time cycle, are firmly established and recorded for the use of the production foundry.

Then, in order to prove the die, one sample casting is passed to the inspection department for marking up to the casting drawing and thereby checking the dimensional accuracy of the die, whilst a radiological examination is carried out on a further sample, or samples (dependent upon the size of the job) to ascertain that faults, not visible to the naked eye, such as internal porosity, shrinkage, blowholes, etc., are not present, thereby confirming that the gating system and general production technique for the die is satisfactory.

Upon receipt of a satisfactory report from both dimensional and radiological examinations, the final production conditions under which the castings had

been produced are tabulated as a form of standard layout (Fig. 1), to which a trial batch, of at least 100 castings, is produced, with, as stated previously, not more than 5 per cent. rejects.

The responsibility of the chief designer and the die development department on this particular die normally terminates with this verification, and the die, together with the relative tabulated data, can then be officially released to the production foundry.

In order that the work involved up to this stage can be more fully appreciated, it is proposed to

FIG. 2.—GENERAL CONSTRUCTION OF DIE FOR FRONT GEAR CASE COVER.

illustrate briefly the production technique of general points of interest in connection with different types of representative dies for Merlin engine parts. With each item is given photographs and a description of the special features of that production part.

Front Gear-case Cover

The die shown in Fig. 2 for producing front gear-case cover castings illustrates to a large extent the advantages to be gained by die-casting and the possibilities of the process. This die embodies many important features in die design and construction which are worthy of note. It is essential to realise that, when considering a job of this description as a potential die-casting, the greatest technical and economical advantages are to be gained ultimately by close co-operation between the die designer and the production engineer, with a view to eliminating as far as possible undesirable features such as undercuts and abrupt changes in section. In the case of the gear-case cover, a very awkward internal flange, which would have meant a collapsible internal core, with the consequent increase in initial die cost with decreased rate of production, was removed to the outside, where it was easily moulded; this without affecting the technical value of the castings.

A substantial base constructed in box form for purposes of rigidity and as a means for housing the ejector mechanism mentioned later, constitutes the major portion of the die. On this base are located two main die blocks forming the outer profile of the casting and location for the top core. Means are also provided for operating these blocks mechanically in the form of a rack and pinion movement. An insert secured in the die base forms the bottom of the casting.

The ejection of the casting is affected by means of a number of ejection pins spaced uniformly round the casting and connected to a steel plate in the base

FIG. 3.—CONSTRUCTION OF TOP CORE OF FRONT GEAR CASE COVER.

of the die, the mechanism being operated through the action of two racks secured to the plate meshing with pinions on a shaft projecting out of the side of the die with a lever attached. Sufficient pressure is capable of being exerted on this lever by one man, thereby ejecting the casting without any distortion or cracking. The object in mechanising the die in this way is so that the introduction of brute force in the operations is avoided, thereby resulting in reduced fatigue on the workers, with consequent increased rate of production.

The intricacy of contour of the inside of the casting

Aluminium Gravity Die-Castings

by the existence of the strengthening webs noticeable in the illustration make it essential to provide the best possible venting conditions in the die cavity. In this respect a study of the construction of the top core is interesting, as it is split up into four main sections, the joint lines corresponding to the centre lines of the strengthening webs. Thus, the provision of vent grooves along the joint faces is facilitated, thereby allowing the air in the die cavity to be easily displaced by the incoming metal without having to resort to the method of forcing or flushing the metal into the mould, a practice which is distinctly bad.

Fig. 3 shows the construction of the core and the method of venting. It will be observed that the four separate pieces are located relative to each other by means of dovetail pieces, thus eliminating the necessity for screws and dowels to hold the pieces together. The assembled core is then secured to a cast-iron top plate, which also serves as a lever plate for removing the core from the casting. This method of construction enables the core to be dismantled easily and rapidly for purposes of cleaning and coating.

FIG. 4.—METHOD OF POURING FRONT GEAR-CASE COVER.

The nature of the alloy being cast demands that adequate head metal be provided over all heavy sections to replace shrinkage during solidification, and for this reason a heavy riser has been placed round the circumference of the casting to feed the thick flange and the heavy bosses thereon. The three heavy bearing bosses and adjacent oil passage bosses in the bottom of the casting are fed from the three conical risers shown. All heavy bosses which are isolated from the feed and which cannot be fed directly by ordinary methods are chilled by removing locally the insulating die coating at that section of the die.

In order to obtain sound castings, the foremost conditions, which must be very rigidly adhered to, in the manufacture of high-class castings, is that the metal must enter the mould cavity in the form of an unbroken stream with the absolute minimum of turbulence.

The ideal way to accomplish this is to direct the metal through a running system to the bottom of the

FIG. 5.—CONSTRUCTION OF COOLANT PUMP CASING DIE.

mould and allow the die to fill by displacement. Certain designs of castings lend themselves to this method, but in the instance of the gear-case cover this method is impracticable, so that alternative methods have to be used to achieve the same end. Furthermore, the plate-like form of the casting accentuates the difficulties, due to the fact that under normal conditions, with the mould flat, it is impossible to maintain a uniform flow of metal across the mould cavity; instead the metal stream breaks up into a number of smaller streams which, upon uniting, tend to form cold shuts and air inclusions. To avoid this tendency the die has been pivoted on trunnions which permit it to be tilted

at an angle at the commencement of pouring and gradually lowered to a horizontal position as pouring proceeds. The operation of pouring is shown in Fig. 4.

To illustrate the extent of the advantages gained by producing this part as a die casting in preference to a sand casting, the following data are given to enable a comparison to be made:—

Detail.	Sand-casting.	Die-casting.
Bonus time allowance to produce	165 mins.	40 mins.
Finished casting weight ..	14 lbs.	12¼ lbs.
Standard cost per casting (S.)	4.042	1.104

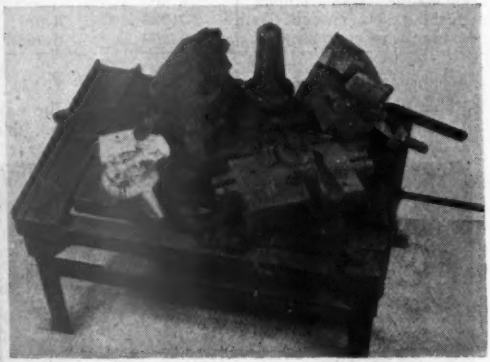

FIG. 6.—CONSTRUCTION OF "BOOST CONTROL" CASING DIE.

Coolant Pump Casing

A gravity die of an entirely different nature for producing coolant pump casings is illustrated with a casting complete with runners and risers in Fig. 5. In this instance the use of sand cores is necessary, which consequently presents the same problems as are experienced in the sand-casting process, *viz.*:—(1) The provision of a suitable design of core print which will give accuracy and consistency of core location; and (2) adequate venting arrangements for drawing off the core gases generated during casting.

Two sand cores are used in this die, one forming the involute passage of the pump, the other forming an undercut pocket in the bottom of the casting, but both representing cases where the use of steel cores would be impossible, nevertheless still resulting in a considerable saving in time and expense over the normal sand-cast methods.

Accurate location of the volute core is provided by means of a core print at each end of the core as shown, each core having the prints checked, in a special jig, for size in relation to the profile of the core before being released as suitable for the die. Venting is important on this core, as the normal tendency of core gases is to follow the course of least resistance and enter the metal, thus forming oxide inclusions and porous regions which would be revealed on pressure testing the castings. A good artificial vent, therefore, is necessary and is found in the centre of the core.

The small circular core, visible in the base of the die, presents similar problems of location and venting, but in this case the difficulties of venting are accentuated by the fact that the core is entirely submerged under a thick layer of metal, resulting in there being only one exit for the gases, namely, through the core print. To influence easy core gas exit the core is located on four tubular pins penetrating to its interior and extending through the base of the die into the atmosphere.

FIG. 7.—METHOD OF POURING "BOOST CONTROL" CASING.

The die consists primarily of a base, which forms half the cavity and also contains underneath it an ejector gear, and two main die halves. The base is constructed in shallow box form and the whole assembly mounted on legs, thus constituting an independent unit.

The circular core, besides forming the inside of the casting, also embodies a central conical riser which is necessary to feed a heavy boss in the bottom of the die. The shape of the casting and the disposition of the thick and thin sections is such that it lends itself to top pouring through the ring riser on the top flange. A smooth entry of metal is attained by pouring simultaneously down two risers, each inclined at 45 deg., whilst the heavy sections at each end of the volute are rendered sound by means of risers. Below are given comparative details of producing coolant pump casings by both "sand" and "die-casting" methods:—

Details.	Sand-cast.	Die-cast.
Bonus time allowance (mins.)	171.000	81.750
Finished casting weight (lbs.)	5.015	4.630
Standard cost per casting (S.)	2.417	0.729

Aluminium Gravity Die-Castings

Boost Control Casing

A good example illustrating the merits of gravity die casting is provided in the case of the die, with a casting therefrom, shown in Fig. 6. As a sand casting, this is difficult to produce under mass producton conditions owing to the large number of separate cores necessary in the manufacture of the moulds, with the consequent effect of increasing the cost and the risk of errors due to the large number of operations involved. Furthermore, the presence of chill and core joint marks on the castings would result in a much inferior surface and accuracy.

On the other hand, the design of the casting lends itself freely to die casting in that a simple die can be designed at a reasonable initial cost capable of producing thousands of sound castings.

The die is parted in three planes, corresponding to faces on the casting, which facilitate the use of an effective running system whilst maintaining ease of

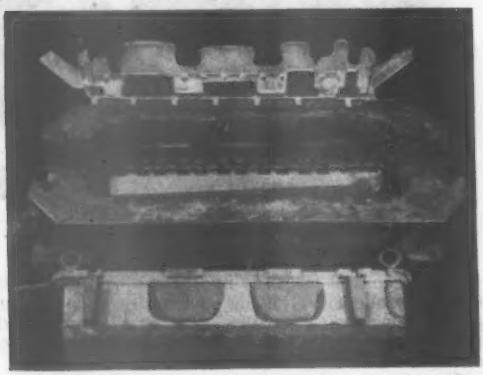

FIG. 8.—CONSTRUCTION OF "ROCKER COVER" DIE.

fettling of the casting and simplicity in die construction. To avoid straining the casting on opening the die, the three die blocks are actuated by means of simple levers pivoted to the die base, light blows on the levers being sufficient to draw the blocks away from the casting with a parallel motion, with the very minimum of strain.

It will be seen that top pouring through the riser has been adapted on this job, the reason for this being that, despite the fact that it would be exceedingly difficult and somewhat impracticable to incorporate an effective bottom running system, the relative positions of the heavy sections demands progressive solidification from the bottom to the top with adequate liquid head metal to feed the heavy sections during solidification. Hence the top runner, which ensures the hot metal being in the risers and the coldest metal in the bottom of the mould. With direct top pouring all the evils associated with turbulent metal become evident; therefore, in this case, to prevent the metal cascading over the intricate die cavity walls, the complete mould is tilted on a pivoted table at a steep angle at the commencement of pour and the metal introduced in a steady unbroken stream, as shown in Fig. 7, the level of the table being returned to the horizontal position as the mould fills.

The undernoted tabulation shows the advantages of die casting over sand casting on this part:—

Details.	Sand-cast.	Die-cast.
Bonus time allowance (mins.)	125.500	35.000
Finishing casting weight (lbs.)	3.928	3.687
Standard cost per casting (S.)	2.250	0.708

Rocker Cover Die

This die illustrates what can be achieved in the way of manufacturing large castings of thin section, this

FIG. 9.—"TWO-HANDED" METHOD OF POURING "ROCKER-COVER" CASTING.

particular casting being some 3 ft. 6 in. long, with a metal thickness of 0.150 in., and is, of necessity, made in an aluminium silicon alloy possessing maximum fluidity. Despite this property, however, auxiliary heating by means of gas burners placed below the base of the die has had to be introduced to assist the metal to run freely. The set-up of this die, together with a casting therefrom, is illustrated in Fig. 8.

The metal is poured, as shown in Fig. 9, from two positions, a sloping runner being situated at each end of the casting and gated into the base of the feeding heads. This method is superior to pouring the metal directly down the feeding head, in that it minimises turbulence. Numerous risers are situated round the top of the casting for feeding purposes.

The presence on the casting of a number of clamp-

FIG. 10.—CORE WITHDRAWING MECHANISM.

ing-down lugs placed below the flange, to facilitate machining in the machine shops, has necessitated the use of drawback cores in the die base to enable the casting to be lifted out. By means of the mechanism shown in Fig. 10, which is actuated by a rack and pinion movement situated at one end of the die, all these cores are withdrawn simultaneously. Moving the longitudinal steel strap shown imparts the necessary motion, through cams and cam paths, to the cores.

The top core forming the inside of the casting is located on four dowels in the die base, one at each corner of the core, thus ensuring accuracy of alignment relative to the die cavity, without relying on the runner blocks. The purpose of mounting the die on special legs is for ease of transport to and from the cleaning and maintaining section. The following are the comparative data of producing rocker cover castings by both sand- and die-cast methods:—

Details.	Sand-cast.	Die-cast.
Bonus time allowance (mins.)	264.000	93.500
Finished casting weight (lbs.)	12.750	9.687
Standard cost per casting (S.)	5.792	1.750

(To be continued.)

REINSTATEMENT IN CIVIL EMPLOYMENT

UNITED STEEL COMPANIES' PROPOSALS

The United Steel Companies, Limited, of Sheffield, are the largest steel producers in the British Commonwealth, and in normal times their employees number over 35,000. For a considerable time they have been giving careful thought to the question of the reinstatement of all their employees now serving in H.M. Forces.

It is felt that with the great majority their paramount desire will be to get back into their old job as quickly and comfortably as possible. Reinstatement is required by law, but the company feels that something more should be done to make the transition from service to civil life as smooth as possible. Authoritative committees have therefore been appointed at each branch, whose task will be not only to welcome those returning from the Services, but to help them to deal with the problems of adjustment which are bound frequently to arise, and to ensure that they suffer no disadvantage through their prolonged absence from civil employment.

In addition, it is felt that there will be a number of men, particularly those who left as juniors or apprentices, who have evinced outstanding qualities of ability and leadership in the Services, and who should be given the opportunity of developing these qualities in civil life both to their own benefit and that of the community. A special training scheme has therefore been evolved to enable such men to qualify for important positions on the executive and administrative staff as and when vacancies occur.

Whilst the scheme will be open to all those who have served in the Armed Forces and Civil Defence Services on a full-time basis, it is obvious that it must be restricted to those whose aptitudes warrant such training, and that the numbers accepted must be related both to the quantity that can be absorbed and to the rate of demobilisation, so that those who are demobilised will not be at a disadvantage.

The course of training is planned to last for twelve months, and to provide the necessary incentive to candidates to prove their ability. A salary will be arranged individually for each candidate, taking into account age, previous experience, and the pay of the rank attained in the Services. A syllabus of training has been drawn up, and this has been designed to be as flexible as possible to meet individual circumstances and the requirements of the company. Such a scheme can only interest a minority, but it is felt that no plan for the satisfactory reinstatement of ex-servicemen would be complete if some machinery were not devised to develop the qualities of ability and leadership which have been disclosed in military service.

John Booth & Sons (Bolton), Limited, structural engineers, has been converted into a public company. The nominal capital has been increased by £90,000 in £1 ordinary shares to £150,000.

IRONFOUNDRY FUEL NEWS—XXVIII

Two more examples of how appreciable fuel savings can result from the more efficient loading of stoves have come to the notice of the Ironfounding Industry Fuel Committee. The first relates to a firm in the Tees-side area which operated four stoves for drying ingot mould cores. By modifying the stove bogies it was found possible to load 18 cores into a stove instead of the previous ten. The use of one stove could then be discontinued altogether, this resulting in the weekly coke consumption being reduced from 24 tons to something under 20.

The second firm, in the West Midlands, was using four similar gas-fired core stoves. When the 25 per cent. cut in industrial gas consumption was imposed, the use of one of the stoves was prohibited, and no difficulty was experienced in maintaining full production on the remaining three. A full batch of cores was collected before any one stove was opened and reloaded. The fuel consumption was reduced in proportion to the number of stoves in use, *i.e.*, a saving of 25 per cent. was effected.

Incidentally, this second case shows that it is possible for some firms to save appreciable amounts of fuel, without loss of production, if the necessary incentive is present. It is, of course, a national duty of every consumer to save the maximum amount of fuel, whether he is "instructed" to do so or not. The Regional Panels of the Ironfounding Industry Fuel Committee are available to assist any ironfounder to this end.

TYRE UPKEEP

Strong sunlight may cause surface cracking of tyres, which may develop into bad cuts. Accordingly, if a driver has the option of leaving a car exposed to strong sunlight, or leaving it in the shade, he should choose the shaded position.

Heat is the greatest enemy of rubber. Speeding generates heat, and therefore is seriously detrimental to tyres. One of the reasons why the larger sizes of giant tyres cannot be made wholly of synthetic rubber is that tyres, so composed, would become far too hot, even when run at a normal speed. At present, the only method of countering this tendency is to mix a proportion of crude rubber with the synthetic.

Water is not directly injurious to tyres. Drivers of farm tractors whose wheels have become badly fouled with manure have been recommended to cleanse them by means of a bucket of water. This course should, however, be adopted only in extreme cases, as water, though not directly injurious to rubber, makes it more susceptible to cuts. Rubber that is to be cut with a knife is often dipped in water to facilitate the process.

Soap is not injurious to tyres. It is to be recommended when a tyre is being fitted and difficulty is being encountered. The soap soon dries off. Oil is an enemy of tyres, and should be kept from contact with them. If, for example, there is a pool of oil on the floor of a garage, the driver should have the oil wiped up instead of driving the vehicle across it.

BRITISH STANDARDS INSTITUTION

DRAFT STANDARDS

The Monthly Information Sheet for September, issued by the British Standards Institution, 28, Victoria Street, London, S.W.1, announces that the following draft standards have been circulated for comment:—

CG (ASB) 7164—Draft Revision of B.S. 835. Asbestos Cement Flue Pipes and Fittings for Domestic Heating Stoves.

CG (GS/SF) 7273—Draft Revision of B.S. 758. Domestic Hot-water Supply Boilers Burning Solid Fuel.

CG (IS) 7282—Draft Revision of B.S. 78. Cast-iron Pipes for Water, Gas and Sewage and Special Castings for use therewith.

CG (HIB) 7311—Draft B.S. for Dimensions of Hinges (Iron and Steel) and Cast-iron Butts.

CG (IS) 7340—Draft Revision of B.S. 44. Cast-iron Pipes for Hydraulic Power.

CG (HIB) 7341—Cast-iron Rainwater Gutters and Fittings.

CG (HIB) 7342—Draft Revision of B.S. 416. Cast-iron Spigot and Socket Soil, Waste, Ventilating and Heavy Rainwater Pipes.

CG (HIB) 7344—Draft Revision of B.S. 460. Cast-iron Spigot and Socket Light Rainwater Pipes (Cylindrical).

CG (HIB) 7960—Draft Revision of B.S. 493. Air Bricks and Gratings.

CG (HIB) 7962—Draft B.S. Baths, Part 2. Materials for Bath Panels.

Amongst new overseas Standards available in the library to members on loan are the following from the [American] Society of Automobile Engineers:—AMS 4422C, Magnesium Alloy Castings (Sand) 6 Al 3 Zn (Solution), AMS 4424C, Magnesium Alloy Castings (Sand) 6 Al 3 Zn (Solution-Precipitation); AMS 4434B, Magnesium Alloy Castings (Sand) 9 Al 2 Zn (Solution-Precipitation); AMS 4484, Magnesium Alloy Castings (Gravity) 9 Al 2 Zn (Solution-Precipitation); AMS 5345, Centrifugal Steel Castings, Chromium Molybdenum, .38-.43 Carbon.

ZINC DEVELOPMENT ASSOCIATION

The report of the Zinc Development Association covering the years 1943-44 has just been issued as a twelve-page booklet. Its activities are shown to include an information service which involved detailed replies to over 1,000 enquiries in one year; a publication department which provides its members and the public with brochures and translations of foreign articles and a library service. Then it has organised, at Oxford, an experimental workshop where work—especially for the building trades—can be carried out.

The Association participates in the work of the British Standards Institution, and is carrying out a campaign to replace the word spelter by that of zinc. A Zinc Alloy Die Caster's Association has been formed, and is now very active.

THE SIDE FEEDING OF STEEL CASTINGS*

A note on the influence of the mechanism of freezing

By B. GRAY, B.A. (Cantab.), English Steel Corporation, Limited, Sheffield.

A striking feature of steel foundry practice during the past few years has been the development in the side feeding of castings. In Great Britain it has taken the form of the, now, well-known "whirlgate" head, which depends for its working on the control of the direction of solidification by the temperature gradient. That principle has long been recognised as important, but it has recently been restated and much emphasised by Batty[1] and by Duma and Brinson[2] in America, and there is some danger that it may be considered to be the only factor of importance in the feeding of steel castings.

The "atmospheric" head has been introduced more recently from America, and has been fully described in a Paper by Taylor and Rominski,[3] which has been reprinted in Britain. It is usually applied in much the same way as the whirlgate head, but it is "blind" and its height is less. In the ordinary way a "dummy" head often fails, owing to the absence of the atmospheric pressure necessary to force the liquid steel from the head into the casting. A device in the form of a small core is used to produce a puncture in the first-formed skin at the top of the head, so that atmospheric pressure is admitted to the top surface of the liquid there. As stated, both heads rely primarily on the directional control of freezing by the temperature gradient which they are admirably designed to produce, but, important as that principle is, there are other factors arising from the mechanism of freezing in steel which should not be ignored.

Much has been written on the freezing of steel in chilled ingots, but the subject has been almost entirely neglected in its relation to the production of steel castings, although information can more easily be obtained from the latter by varying the methods of running and feeding.

For the present investigation, blocks 4 in. by 4 in. by 18 in. were made in four different ways (see Fig. 1): Example A, cast vertically with a bottom runner and top head; Example B, cast horizontally with a whirlgate head at one end; Example C, cast vertically through a top head, and Example D, cast vertically with a whirlgate head under the bottom. The results obtained from the experiments are reported here, and their bearing on the feeding of steel castings is discussed.

Solidification from the Mould Wall

It seems to be assumed in most recent publications that steel freezes by a uniform thickening of the wall under all circumstances, except in so far as the process is modified by variations in the thermal capacity and conductivity of the moulding material and by the shape of the mould. That the assumption is not true is proved by the photographing of sulphur prints of a 4 in. by 4 in. by 18 in. casting with a large head bottom-run and made vertically (Example A). After 10¼ min. the bottom box was dropped off and 7½ in. of the casting were cut off with an oxygen lance. A small amount of liquid drained out, but the casting was solid, except for small unusual types of cavities. The thickness of the wall of the casting, undisturbed by the draining operation, varies, and is everywhere less than 1 in., and it is evident that there was much loose solid matter in the interior, with only a small amount of liquid. Some of the liquid had come down from the top of the head, as is shown

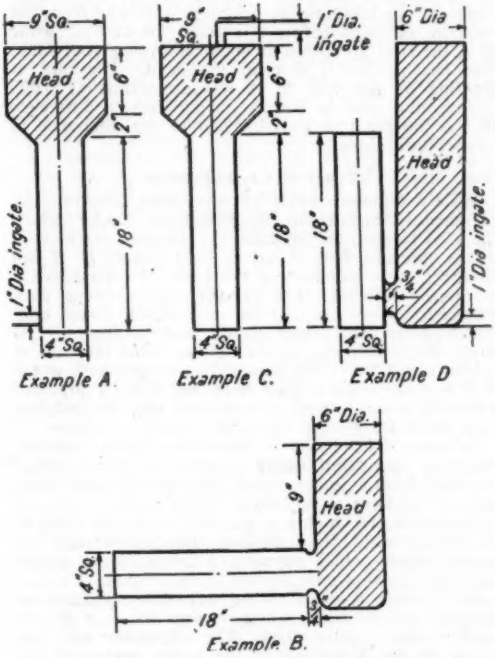

FIG. 1.—SKETCH OF CASTING DESIGNS.

* Extracted from a Paper published by authority of the Steel Castings Research Committee of the Iron and Steel Institute.

The Side Feeding of Steel Castings

by the fact that the dark patch on the sulphur print, indicating sulphur segregation, is unusually small there. Two specimens of Example B were drained after 8½ and 4½ min., respectively, by burning a hole in the bottom of the head. They are similar castings to A, but were made horizontally with the whirlgate head, and a few drops only were obtained from the centre-line of the one drained after 8½ min. In the casting, freezing had taken place almost entirely by growth from the walls of the casting, at a rate that agrees fairly closely with that obtained by mathematical calculation, which is of the order of 0.2 in. per min.

Thermocouples in similar castings showed that Example A froze completely in 17 min. and Example B in 12 min., a difference caused by the method of running. In Example B, heat was absorbed from the steel in the head before it entered the casting, while in A the steel all passed through the casting and would lose heat before it reached the head. The rate of freezing of the wall in A was approximately 0.095 in. per min. and in B 0.23 in. per min., a difference that is too great to be attributed to the difference in temperature alone.

Types of Crystallisation

Widely different kinds of crystalline structure are obtained, according to the conditions under which the steel freezes; for instance, the analyses of the steel in the top and bottom halves of Example B, if not identical, were similar, but the form of crystallisation is utterly different. The central core showing dark on the sulphur print, on the other hand, would contain considerably more carbon and sulphur. The study of the different crystals in steel and their distribution is a difficult and contentious subject with which it is not proposed to deal here, but from a practical point of view it can be assumed that in ordinary steel there are always these two forms of solid:—

Primary.—The bulk of the solid, having varying structure, but conforming closely to the analysis obtained from a spoon sample, though with increasing impurity content as solidification proceeds.

Secondary.—A highly segregated solution, containing considerably more sulphur and carbon than the spoon sample, which appears to freeze almost simultaneously over a considerable area.

In Example A most of the secondary solidification occurred in the head, where it appears as a brown patch in the sulphur print. The remainder was contained in the V-threads in the upper centre of the casting and in minute particles well distributed through the remainder of the section. It should be noted that the bottom third of the casting was exceptionally free from segregate and, containing on the whole the purest steel, froze at the highest temperature.

As it is, the casting contained only minute defects on the centre-line, but, if the highest-freezing-point material had not collected at the bottom, it is clear that the casting must have been unsound. That is to say, if such a casting really froze only from the mould face inwards at a rate proportional to the dissipation of heat, no casting of uniform section bottom-run with a top head could possibly be sound, as it would freeze more slowly at the bottom, where the sand has been heated by the incoming metal.

When the same casting was made vertically and run through a top head (Example C), the distribution of the segregate was similar to that in Example A, but the columnar wall was considerably thicker at the bottom end of the casting, and the V-segregates, confined to the upper half, were less pronounced and flatter. On the other hand, in Example B, with the casting made on the flat, freezing was almost entirely inwards from the walls, and when the solidified matter met at the centre the secondary residue was squeezed towards the head in a passage tapered by the temperature gradient induced by the method of running. There it was blocked by the material in the head, which was pure and of high melting point and therefore froze first, although it was at a higher temperature. As a result there is a slight unsoundness due to the freezing and contraction of the secondary material later.

Example D, cast vertically with a whirlgate head, is different again, the crystal structure presenting a confused appearance, and not a marked pattern about the centre-line as in the other cases. The columnar wall is very thin, and the sulphur print indicates that the segregate is uniformly distributed, except for a faint streak running from the centre-line in a curve towards the neck.

Convection Currents

Reviewing these four samples, one is driven to the conclusion that the differences in the behaviour of the steel in freezing are influenced by convection currents in the liquid. In Example B these currents were almost entirely absent, owing to the small vertical height and the fairly even temperature gradient, while in Example C they were not powerful, owing to the steel in the bottom of the mould having entered first and therefore being the coolest. In Example A they were more powerful, because, owing to the method of running, there was hot steel in the bottom when casting was completed, the hot steel rising to the top as soon as the turbulence due to running ceased.

In Example D convection currents were relatively strong, and the steel entered hot at the bottom, which was also kept warm by the connection with the head, while the top of the casting was coolest when casting was completed. Immersion thermocouples, placed on the centre-line of a similar casting, showed that the position was reversed immediately afterwards, and the steel nearer the top became the hotter and remained so till freezing was almost completed. Owing to the convection currents, the steel near the walls was relatively warmer, the wall growth was slower and most of the crystal growth took place from nuclei in the liquid. Final solidification was from the top downwards, however, as convection currents ceased in the later stages and heat dissipation was more rapid from the top.

Convection currents are also of importance in side heads, and here the advantage lies with the atmospheric type. It is shorter in comparison with its bulk than the whirlgate head, and therefore convection currents are less pronounced. Also, the top surface is kept hot, because it is insulated by sand from the atmosphere, and later, as soon as the level of the liquid has fallen, there is an insulating layer of gas or air to prevent still further the loss of heat from the top surface. Thus, the tendency for the hot steel at the bottom to be replaced by that which has been cooled down at the surface is much reduced, and the temperature is kept up opposite the entrance to the casting, where it is required. Incidentally, the effectiveness of the various feeding materials used on the top surfaces of the liquid in open heads is at least partly dependent on the same principle, and they tend to keep the liquid hot at the base of the head near the casting, as well as at the surface.

The Effect of the Size of the Section on Crystallisation

Steel in freezing does not behave in the above way in castings with a thickness less than about 3 in., because after the preliminary growth of the columnar wall is finished there is no time for marked segregation to take place or room for convection currents to occur. The secondary crystallisation, therefore, is widely dispersed along the whole of the centre of freezing, and is associated with slight unsoundness. For that reason it has been found impossible to cast thin plates free from at least microscopic unsoundness by ordinary methods of feeding.

Taylor and Rominski[4] have described the unsoundness produced in the bottom half of a 2-in. plate cast with an atmospheric head applied to the middle of the plate.

Factors Controlling Feeding

It is thus evident that controlled direction of solidification brought about by the temperature gradient is by no means the only factor in feeding the steel casting, and that for some castings the normal method of bottom-running with the top head is satisfactory, even in theory, in spite of the temperature gradient being in the wrong direction. The full benefit of the favourable temperature gradient with the whirlgate head is not obtained, because high-melting-point material collects at the bottom of the head and may freeze earlier than the low-melting-point material in the casting if the temperature difference is not sufficient. Then, again, the segregated material can escape into the head more easily with a top head, as it tends to rise naturally, owing to its lower specific gravity. In doing so, it enriches the steel in the head and lowers its freezing point below that of the casting, which, of course, helps feeding. It is only in a top-run casting with a top head that the temperature gradients and the relative freezing points of the part of the casting last to freeze and of the material fed to it are all favourable.

The Secondary Liquid

The amount of secondary material collecting near the head in a casting, such as Example B, will depend partly on the composition of the steel (with high carbon and sulphur it will be greater), and partly on the amount of steel that the head is feeding. Thus, the secondary material in Example B is the residue from the whole of the steel in the casting. If the casting had been 12 in. long instead of 18 in., there would have been little or no unsoundness, and most of the secondary material would have escaped into the head.

Atmospheric Pressure

Another source of danger in the use of the whirlgate head, and even more of the atmospheric head, may lie in the strength of the columnar wall at the top of the casting. This is well illustrated by a repeat of Example D, which was made in a skin-dried mould insufficiently dried at the top, causing blowholes. These blow-holes constituted a puncture of the skin similar to that produced by the core in the atmospheric head, and it seems probable that the gas present set up sufficient pressure to overcome for a time the ferrostatic pressure from the head, and feeding took place from that point instead of from the head. It is difficult to picture exactly what happened, as it is hardly conceivable that there was sufficient gas pressure to overcome the pressure from the head throughout the period of freezing. The most likely explanation seems to be that the greater part of the casting inside the columnar wall was a mixture of liquid and solid like the contents of a cocktail-shaker, all freezing simultaneously, with some rather highly segregated liquid at the top. By that time, the level of the liquid in the head may have fallen to that in the casting and frozen over owing to contact with the atmosphere. At the same time, the gas contained in the top of the casting would thermally insulate the surface of the liquid there and prevent it from freezing over, thus maintaining atmospheric pressure. Under those conditions material would be sucked from the casting into the head, with the kind of result shown. A piece of broken mould floating up on the steel can have the same effect.

Application in Whirlgate Heads

It is common experience with the whirlgate head that failures are more likely to occur when the steel is cold: Example B, is cast very cold at the end of the heat, and is actually almost short-run on one corner, where there may be a deep cold-lap. In such cases it seems probable that small crystals of high-melting-point material had already formed in the liquid while the casting was still being run, and froze rapidly on contact with the sand. With solidification starting at such an early stage, there would be no time for the lower rate of dissipation of heat in the head to have its full effect in retarding solidification there, as compared with the cooling rate in the casting. A casting so made would be the least sound of several made in the same way.

The Design of the Neck

A thin and relatively deep angle of sand is necessary to obtain the full benefit of the reduced neck in Example B, and therefore, when the head is applied to a face of the casting of dimensions similar to those

The Side Feeding of Steel Castings

of the section to be fed (as here), it is not safe to make any reduction at all. In the same way, it is difficult to apply the whirlgate head to a round bar or tube, because the angle of sand is not sufficiently thin to maintain the temperature of the neck. On the other hand, where a really thin layer of sand can be employed, castings can be fed through surprisingly small necks, no larger than runners and which can be removed from the head with a sledge-hammer. A ring casting is one which proved entirely satisfactory.

The Choice of the Type of Head

Examination of all the foregoing observations suggests that generalised statements of practical application in the foundry can be made regarding the type

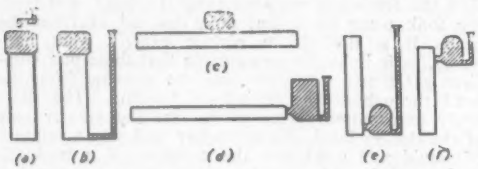

FIG. 2.—VARIOUS TYPES OF FEEDER HEADS.

of head giving good results in any particular case. These are very briefly set out below:—

(1) Atmospheric pressure and not gravity is the effective motive force in the feeding of all castings.

(2) Top-running through the head is effective in sections greater than 3 in., particularly when the shape of the mould is favourable (see Fig. 2 (*a*)).

(3) Bottom-running with top heads is satisfactory under the same conditions (see Fig. 2 (*b*)).

(4) Top heads are not efficient in sections less than 3 in. thick.

(5) Top heads are not efficient in horizontal feeding (see Fig. 2 (*c*)).

(6) Side heads give a greater depth of solid wall in horizontal feeding and are therefore to be preferred in certain cases (see Fig. 2 (*d*)).

(7) Side heads are effective to a considerable horizontal distance from the head.

(8) Side heads in horizontal feeding are liable to leave slight axial unsoundness in the casting.

(9) Side heads applied to the bottom of a casting give the best results in sections under 3 in. thick, and are quite effective for thicker sections when applied so that the head keeps the bottom of the casting hot by conduction (see Fig. 2 (*e*)).

(10) Side heads are not so effective when applied to the top of a casting (see Fig. 2 (*f*)).

(11) The conduction of heat from the head to the casting during freezing is important, and is controlled by the size of the head and the design of the connection with the casting.

In the foregoing estimation the size of the neck is ignored, as, from the feeding point of view, a reduction there can equally well be applied to top heads. In practice it is not so convenient, but that and other practical considerations affecting the cost of production are not discussed here.

The number and variety of the examples and the observations of temperature, chemical analysis, etc., made have been much restricted in this investigation by the superior claims of production in both the foundry and the research department. These limitations are still so serious as to make it impossible to undertake, in the immediate future, an adequate research on the points of interest disclosed, and it has been arranged that further co-operative investigation shall be carried out under the auspices of the Steel Castings Research Committee.

It is gratifying to the Author that the Committee have undertaken this work, and he is personally indebted to the Chairman and other members for advice and assistance already given. These notes are submitted for publication because, whatever their scientific value, they appear to present features of practical importance and will also serve an an introduction to the new programme of research.

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[1] G. Batty: "Transactions of the American Foundrymen's Association," 1934, vol. 42, p. 237.

[2] J. A. Duma and S. W. Brinson: "Transactions of the American Foundrymen's Association," 1940, vol. 48, p. 225.

[3] H. F. Taylor and E. A. Rominski: "Transactions of the American Foundrymen's Association," 1942, vol. 50, p. 215; THE FOUNDRY TRADE JOURNAL, 1942, vol. 68, Oct. 15, p. 135; Oct. 22, p. 171; Oct. 29, p. 193.

[4] H. F. Taylor and E. A. Rominski: "Transactions of the American Foundrymen's Association," 1943, vol. 50, p. 711.

BOOK REVIEW

"The Equilibrium Diagram of the System Copper-Tin"; "The Equilibrium Diagram of the System Copper-Zinc," and "The Equilibrium Diagram of the System Copper-Aluminium." By G. V. Raynor, M.A., D.Phil. The Institute of Metals, 4, Grosvenor Gardens, London, S.W.1. (Price 6d. each, post free.)

The Institute of Metals has just added the above three alloy systems to its Annotated Equilibrium Diagram Series (Nos. 2, 3 and 4). These are the systems most requested by members when the series was first announced a year ago. Each of the series consists of (1) the diagram reproduced on a generous scale and based on what is regarded as the most reliable work in each phase field; (2) a table giving all important data connected with the diagram; (3) a number of critical notes, and (4) a list of references. The first number of the series (the aluminium-zinc system) is still available.

Commander Sir Charles Craven, Bt., has been elected president of the British Employers' Confederation in succession to Sir Harry F. Brand.

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USING WAR EXPERIENCE FOR PEACE PRODUCTION

SIR GRAHAM CUNNINGHAM'S VIEWS

Addressing the Engineering Industries Association at Birmingham recently, Sir Graham Cunningham spoke of the increased knowledge of production which had been acquired during the war by workpeople and managements, and advocated a continuance of the wartime collaboration between them, and, in the larger sphere, a continuance also of such international collaboration as is represented by the Combined Production and Resources Board. Sir Graham said a vast number of workpeople who, until the war, had never been in a factory in their lives, had now been trained to factory life and conditions. Many of them knew how to set their tools and, indeed, many girls had learnt such proficiency that they had become semi-skilled, some of them even verging on being skilled craftsmen. Many men who were craftsmen in one trade had perforce learnt another trade. On the whole, management in this country pre-war was not on a high level. We had a number of people who occupied the position of managers, but who really had no proper training for the task. Vast numbers of small concerns just doing general engineering and other jobs jogged along on inefficient machines in an inefficient way with inadequate facilities. They did their work because of a local demand which they were able to fulfil. A vast number of new machine tools had been introduced into factories and the possibilities of these machines shown to those who had never realised before what general-purpose plant could do in the way of production.

The speaker hoped that in many factories after this war there would be information rooms where workers, staff and management would be able to see by map, text and photograph something of the manner in which their products were being used in foreign countries, the people who were using them, and the work they were doing. Sir Graham thought we should require to see a great increase in the number of works training schemes to encourage and help recruits to industry. The menace of the blind-alley job must be removed. It was time we educated our young people to understand that British industry was not merely the business of making things, but a romance and the basis of all our progress. He believed, too, that the relationship between management and the unions had become closer as well as the relationship between unions and their members. In other words, the human relationships among all classes had been brought closer together in fighting a common enemy and in equally sharing the hardships and suffering of war.

Scientific Research

The speaker said we must make use of scientific research in our factories. The scientist must have the *entrée* into business problems in peace as he has helped us in war. We had learnt that this country and the English-speaking peoples of America must in future walk hand-in-hand in friendly partnership. There would be competition, and keen competition, but an understanding of nations must be established. We had had the experience of the working of the Combined Production and Resources Board, where problems of production had been argued out between the two countries, and raw materials fairly distributed so as to integrate the production plans of our three countries, U.S., Canada and Great Britain. It might be more difficult to operate such a combined board in peacetime, but he believed that the work of this and similar organisations, started under the compelling needs of war, must be continued if the nationalism which impeded our progress in the past was to be avoided in the future.

Sir Graham ended his address with a demand for a courageous attitude towards the problems of peace.

FROM WAR TO PEACE PRODUCTION

SIR C. BRUCE-GARDNER'S APPOINTMENT

The Board of Trade announces that in view of the increased responsibilities now falling on the Board in connection with the planning of the change-over, subject to the prior claims of the war effort, of British industry from war to peace production, Mr. Dalton has appointed Sir Charles Bruce-Gardner to be his Chief Executive for Industrial Reconversion. Sir Charles has been released for this purpose by the Minister of Aircraft Production.

He has been for two years a member of the Council of the Minister of Aircraft Production and Controller of Labour Allocation and Supply in the Ministry, as well as chairman of the Production Efficiency Board. He was a member of the Civil Aviation Planning Committee in 1939, of the Secretary of State for Air's Industrial Advisory Panel, 1938-39, of the Air Council Committee on Supply, 1938-40, and of the Air Supply Board, 1940-41. He is a member of the Institute of Mechanical Engineers.

Sir Charles Bruce-Gardner was for some time a director of John Summers & Sons, Limited, and chairman of Armstrong Whitworth Securities, Limited, New Jarrow Steel Company, Limited, Sir W. G. Armstrong Whitworth & Company (Engineers), Limited, and the Society of British Aircraft Constructors, Limited. He has also been chairman of the Iron and Steel Industrial Research Council, a member of the Advisory Committee of the Department of Overseas Trade and industrial adviser to the governors of the Bank of England.

Guarantors of the recent issue of ordinary shares by the Anti-Attrition Metal Company, Limited, will take up about 9 per cent. of the shares. The shares, numbering 250,000, were offered at 3s. 6d. each in the proportion of one for every seven held on October 7 last. The directors undertook to subscribe at 3s. 6d. for any shares not taken up in consideration of a fee of 3d. per share on the total number of shares offered.

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Also

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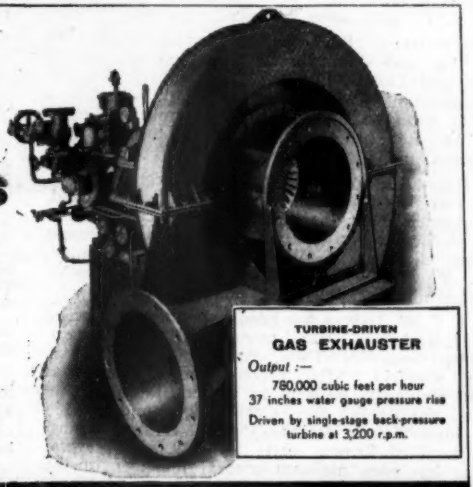

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Output :—
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37 inches water gauge pressure rise
Driven by single-stage back-pressure turbine at 3,200 r.p.m.

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PERSONAL

MR. G. A. LEITCH, chairman of Cannon Iron Foundries, Limited, Deepfields, near Bilston, has resigned from the board.

CAPT. DAVID JAMIESON, of King's Lynn, who has been awarded the V.C., is the son of Mr. A. A. Jamieson, chairman of Vickers, Limited.

MR. F. R. CASS, chairman and managing director of F. R. Cass, Limited, engineers and ironfounders, of Bury, has celebrated his 80th birthday. On October 26 he was entertained at luncheon at the Grand Hotel, Manchester, by a number of friends in the Lancashire iron and steel trades.

MR. E. J. LOWE, a local director of Thos. Firth & John Brown, Limited, Sheffield, has been appointed works manager of the company's Atlas and Norfolk Works. He has been assistant works manager since 1935, and was awarded the O.B.E. this year. He has been at the works for over 33 years.

MR. WILLIAM WILKINSON WOOD, J.P., was installed for the fifth year in succession as Master Cutler in Sheffield recently, thereby creating a record for length of service in the office. He previously held the office for one year in 1924. He is a director of Darwins, Limited, the Sheffield steelmakers.

MR. HERBERT INGRAM SIMMONDS has retired from the post of chief draughtsman at Dorman Long & Company's central engineering department after 52 years' service with the company. His retirement was marked by a presentation made on behalf of the staff by Mr. E. T. Judge, chief technical engineer.

MR. WILLIAM C. BELL, general manager since 1939 of the iron and steel works, mines and quarries of Stewarts and Lloyds, Limited, Corby, has now taken up an appointment with his firm as joint director, with Mr. E. G. Saunders, of research and technical development. Mr. Bell has been appointed a local director of Stewarts and Lloyds.

MR. ERIC MENSFORTH, who has been elected a director of Thos. Firth & John Brown, Limited, Sheffield, and appointed managing director of the company, is a son of Sir Holberry Mensforth, and is at present managing director of Westland Aircraft, Limited, Yeovil. Previously he was assistant managing director of Markham & Company, Limited, Chesterfield.

MR. J. T. W. DEWAR has been appointed to succeed Mr. J. H. Barber as general manager of the Engineers' Tool Department of Thos. Firth & John Brown, Limited, Sheffield. After a course of engineering at Sheffield University he went to Vickers, Limited (subsequently the English Steel Corporation), and in 1934 joined Firth-Vickers Stainless Steels, Limited, transferring to Firth-Browns early in 1939. For several years he has been assistant general manager of the Engineers' Tool Department.

SIR ARTHUR MATTHEWS, who has been appointed managing director of Thos. Firth & John Brown, Limited, has been assistant managing director and works general manager since 1938. He was knighted in 1941. After taking his engineering degree at Cambridge, he became an apprentice at the Openshaw works of Armstrong, Whitworth & Company, Limited. From assistant to the works manager he became works manager of the steelworks, engineering and ordnance departments at Openshaw, and during the last war was awarded the O.B.E. for his work in accelerating the output of guns. He joined Thos. Firth & Sons, Limited, in 1922 as works manager and local director, and on the fusion with the steel-producing interests of John Brown & Company, Limited, in 1931, he was appointed works general manager and local director, including their Scunthorpe factory. He became a director in 1934. Sir Arthur Matthews is also a director of Firth-Vickers Stainless Steels, Limited, chairman of Firth-Derihon Stampings, Limited, and a director of Markham & Company, Limited, Chesterfield. In May, 1944, he became chairman of the Aircraft Sub-Committee of the Special and Alloys Steels Committee of the Ministry of Aircraft Production. Later he became chairman of the Advisory Committee on Special and Alloy Steel Supplies to the Ministry of Supply.

Wills

BYNG, E. G., of Northampton, a director of the General Electric Company, Limited £295,934

GOLDSTONE, M. H., chairman of Ward & Goldstone, Limited, Salford, manufacturing electrical engineers £82,090

SALMON, HARRY, of West Hartlepool, works manager and a director of the Expanded Metal Company, Limited £19,266

CASE, COM. H. K., R.N.R., a director of Brown, Colby & Case, Limited, iron and steel merchants, Great Yarmouth £6,801

WOOD, A. L. S., managing director of R. & A. Main, Limited, and joint managing director of Glover & Main, Limited £89,826

NUTTALL, J. S., of Chalfont St. Giles, for many years managing director and chairman of Platt Bros. & Company, Limited £31,921

BALL, E. BRUCE, managing director of Glenfield & Kennedy, Limited, a former president of the Institution of Mechanical Engineers £70,120

HENDERSON, SIR FREDERICK NESS, of Monkton, formerly chairman of D. & W. Henderson & Company, Limited, shipbuilders, of Glasgow ... £45,755

OBITUARY

MR. JOHN R. LAMB, a director of the International Nickel Company of Canada since 1938, died at Toronto on October 29.

CAPTAIN JULIAN LYTTELTON, Grenadier Guards, second son of Mr. Oliver Lyttelton, Minister of Production, has been killed in action in Italy.

MR. SYDNEY BENJAMIN WHEWAY, one of the oldest industrialists of Walsall, died on October 27 at the age of 87. He was head of Job Wheway & Son, Ltd., cart gear and chain manufacturers, of Walsall. He had been a borough magistrate since 1892.

MR. ALEXANDER HALL WILSON, chairman of Hall, Russell & Company, Limited, shipbuilders, iron and brass founders, etc., of Aberdeen, has died. He was well known in the shipbuilding industry both in this country and on the Continent. He was a great-grandson of Alexander Hall, the famous builder of clippers.

FUNDAMENTALS OF CIVILISATION

No. 8 THE WRITTEN WORD

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The monkish pen was mightier than the military sword, the one gave life to the spirit, the other only death to the body.

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The power of the pen has been multiplied till it becomes the power of the Press, that Archimedian lever which can influence the world of men. When the printing machines, with thunderous voice and lightning speed, multiply words—words—words, they tell a million men at dawn what only one man knew at midnight.

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FIRTH-BROWN APPOINTMENTS

The directors of Thos. Firth & John Brown, Limited, Sheffield, have made the following arrangements with a view to establishing their post-war organisation:—

Sir Allan Grant retired from the position of managing director of the company as from the end of last month, but is retaining his seat on the board.

Sir Arthur Matthews has been appointed managing director of the company.

Mr. Eric Mensforth has been elected a director of the company and has been appointed deputy managing director.

Mr. J. H. Barber, a local director, who has been with the company since 1905, retires from the position of general manager of the Engineers' Tool Department, and is succeeded by Mr. J. T. W. Dewar, who has been appointed general manager of that department and a local director of the company.

Mr. E. J. Lowe, a local director, has been appointed works manager of the Atlas and Norfolk Works.

As a first stage in relinquishing some of his business responsibilities, Sir Holberry Mensforth has retired from the boards of Thos. Firth & John Brown, Limited, Dalton Main Collieries, Limited, and Markham & Company, Limited.

IRON AND STEEL INSTITUTE

AUTUMN MEETING

The autumn general meeting of the Institute will be held at the Institution of Civil Engineers, Great George Street, London, S.W.1, on November 23, 1944, at 11 a.m., and 2.45 p.m., and on November 24, 1944, from 10.30 a.m. to 1 p.m. No dinner or luncheon for members will be held.

The meeting will be devoted to a discussion on blast-furnace operation and problems, based on the following Papers:—

Paper No. 1: "Ironmaking at the Appleby-Frodingham Works of the United Steel Companies, Limited," by G. D. Elliot and the staffs of the Appleby-Frodingham Ironworks, Scunthorpe, and of the Central Research Departments, Stocksbridge (the United Steel Companies, Limited) (Special Report No. 30).

Paper No. 2: "Considerations on Blast-furnace Practice," by T. P. Colclough, D.Sc., M.Met., F.R.I.C. (London).

CONTRACTS OPEN

The date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Belfast, November 27—Gas cookers, heating stoves and other appliances, gasmeters, and boiler tubes, for the Town Council. The Engineer and Manager, Gasworks, Ormeau Road, Belfast.

Melton Mowbray, November 27—Supply and laying 2¼ miles of 4-in. and 3-in. dia. water mains of spun or cast iron, and supply of valves, hydrants and other fittings, for the Melton and Belvoir Rural District Council. The engineers, Pick, Everard, Keay and Gimson, 6, Millstone Lane, Leicester. (Fee £1 1s., returnable.)

NEWS IN BRIEF

THE DIRECTORS of Kendall & Gent (1920), Limited, propose to change the name to Kendall & Gent, Limited.

THE BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY, LIMITED, is being wound up voluntarily. Mr. J. B. Prentice, 7-8, Norfolk Street, Strand, London, W.C.2, is the liquidator.

THE COMPANIES REGISTRATION OFFICE gives notice that the names of the undermentioned companies have been struck off the register, and such companies are dissolved:—Kirkgate Engineering, Limited; Metallurgical Industrial Processes, Limited.

THE ANNUAL GENERAL MEETING of the Institution of Production Engineers will be held on Friday, November 24, 1944, at 2.15 p.m., at the Institution of Civil Engineers, Great George Street, London, S.W.1, when Sir Robert McLean will deliver his presidential address on "Some Post-War Problems in the Engineering Industry."

THE TYNESIDE INDUSTRIAL DEVELOPMENT BOARD, an organisation formed some years before the war with the object of attracting new industries to the district, is to resume its activities which have been suspended on account of the war. The Board is to co-operate if possible with the recently-formed North-East Development Association.

ACCORDING TO Sir William Darling, chairman of the Scottish Council on Industry, Scotland will have a big share in the manufacture of interior fittings for the Portal houses. He remarked that, generally speaking, what might be called the carcase of the house would be made in England, and the internal fittings, which formed two-thirds of the Portal house, would be made in Scotland.

PARLIAMENTARY NOTES

Diversion of Foundry Labour

MR. J. GRIFFITHS asked the Minister of Supply if he was aware of the shortage of kitchen ovens; and if he would release supplies of iron and steel so as to make available an increased supply of ovens.

MR. PEAT: I understand from the Minister of Works that there is some difficulty in meeting civilian requirements for kitchen ranges. The shortage is not due to lack of materials, but to diversion of foundry labour to war production. Steps are being taken to re-transfer labour as rapidly as war production permits.

Location of Industry

MR. DALTON, in reply to a question in the House of Commons, said it was not the Government's intention to enforce upon industrialists any particular areas for the location of their enterprises, whether old or new. But, in accordance with Chapter III of the White Paper on Employment Policy, the Board of Trade are inviting the attention of industrialists, who are looking for premises, to those areas which need a greater diversity of industry.

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Raw Material Markets

IRON AND STEEL

The issue of licences for the various grades of foundry iron is very carefully controlled. Consumers are not permitted to acquire additional supplies if their stocks exceed a fixed quota, and as the call for both light and heavy castings is limited, the turnover in pig-iron is not large. It had been hoped that the starting up of one or two additional blast furnaces would be possible, but the coke position is acting as a drag on this development, while the labour situation militates at the moment against the manufacture of a greatly increased tonnage of builders' castings, urgently needed in bomb-damaged areas. The long-continued scarcity of hematite helps to sustain the steady demand both for refined iron and low- and medium-phosphorus grades, but these requirements can still be met at short notice, whilst basic iron production keeps pace with steelworks' needs.

The scrap supply position continues to be easy. First-class cast-iron scrap and machinery metal are still in strong demand, but there is no difficulty in meeting requirements. There is a surplus of almost all the lighter grades.

Foundry coke is not in such good supply as it has been during the past few months, and consumers who have put in stocks have been well advised. It is probable that some form of rationing will be brought into use during the winter.

Consumption of both prime and defective billets, sheet bars, wire billets and rods is maintained at a high level, but producers are apparently able to satisfy all the requirements of the re-rolling industry. Prior to the war very large tonnages of semi-finished steel were imported from the Continent, and to have achieved self-sufficiency in this respect under the impact of war is an industrial development which may have important effects when the industry reverts to peacetime production.

In the finished-steel trade, conditions have undergone little change. For all the lighter products such as small bars, light structural sections, rounds, squares, tees and flats, there is a sufficiency of orders in hand to ensure regular working up to the end of the year. Wire mills, too, are working to capacity, and the sheet mills have an abundance of orders for the lighter gauges, although the position in regard to heavy sizes is not so favourable. The contrast in the heavy-steel trade, however, is most marked. The big section mills are working irregularly and plate mills are operating on a hand-to-mouth basis, whilst the demand for special steels is on a much reduced scale.

NON-FERROUS METALS

The call for non-ferrous metals from manufacturers continues to decline. Until there is a greater number of civilian orders to take the place of the reduced munitions contracts, there is not likely to be any increase in consumption. Although there have been curtailments of our copper purchases from Rhodesia, large shipments are still arriving in this country. The tonnage now held in the United Kingdom must by this time be very large, and, taking the scrap position into consideration, it seems that there must be a considerable surplus of the metal on hand. It was announced last week that more brass is to be allowed for house fittings, and it is probable that there will soon be further relaxations of the restrictions on the use of copper.

Tin is still comparatively scarce, and is likely to remain so for a considerable time—even after the defeat of the Japanese. It may be several years before production can be resumed in the Far East. However, supplies of tin for essential undertakings are quite adequate, although strict economy in their use has to be observed.

Supplies of zinc are plentiful, and, together with copper, further civilian allowances have been made. Increased quantities can be used for articles required for house construction or equipment. One of the most important releases is brass for the production of curtain rails. These additions are very welcome to manufacturers.

COMPANY RESULTS

(Figures for previous year in brackets)

Thompson Bros. (Bilston)—Final dividend of 7½% (same) and bonus 7½% (same), making 22½% (same).

British Timken—Profit to December 31, 1943, £177,984 (£151,193); to depreciation, £34,614 (£25,030); provision for taxation, £75,000 (£63,000); to contingencies reserve, £20,000 (same); to general reserve, £8,006 (nil); forward, £31,592 (£28,731).

Wright, Bindley & Gell—Net profit for the year to June 30, 1944, after directors' fees, depreciation and war damage, £11,667 (£11,969); preferred ordinary dividend of 7$\frac{5}{16}$% (same) (including additional dividend of ¼d. per share); deferred dividend of 6¾% (same); towards future deferred dividends, £28 (£29); to general reserve from profits, nil (£2,000); transferred for an available reserve in investment account, £2,000.

Murex—Trading profit for the year to June 30, after depreciation, £412,514; net dividend from the subsidiary, £30,000; sundry revenue, £509; total income, £443,023; reserve for taxation, less £40,000 over provided, 1940-43, £200,000; net profit, £239,446 (£193,007); ordinary dividend of 20% (same); to general reserve, £25,000; to obsolescence reserve, £50,000; written off plant, £27,075; to war personnel reserve, £10,000; written off investment in associated company, £5,931; forward, £125,398.

Thos. Goldsworthy—Trading profit for the year to June 30, 1944, £30,859 (£40,309); directors' fees, £1,242 (£1,300); N.D.C., £1,974 (£1,744); interim preference dividend of 7½%, less tax, £5,625 (same); ordinary dividend of 6% (5%); to reserve for taxation, £3,000 (£12,000); to general reserve, £5,000 (£7,500); forward, £1,091 (£1,000).
his 68th year.